**PROJECT DESIGN DOCUMENT FORM
FOR SMALL-SCALE CDM PROJECT ACTIVITIES (F-CDM-SSC-PDD)
Version 04.1**

# PROJECT DESIGN DOCUMENT (PDD)

| | |
|---|---|
| **Title of the project activity** | India-FaL-G Brick and Blocks Project No.1 |
| **Version number of the PDD** | Version 05 |
| **Completion date of the PDD** | 02/09/2013 |
| **Project participant(s)** | Eco-Carbon Private Limited (ECPL) (India)<br>International Bank for Reconstruction and Development as the Trustee of the Community Development Carbon Fund (CDCF) (Italy)<br>International Bank for Reconstruction and Development as the Trustee of the Community Development Carbon Fund (CDCF)<br>(The Netherlands) |
| **Host Party(ies)** | India |
| **Sectoral scope(s) and selected methodology(ies)** | Sectoral Scope : 04<br><br>AMS-II.D (Version 07 : 28 November, 2005): Energy efficiency and fuel switching measures for industrial facilities |
| **Estimated amount of annual average GHG emission reductions** | 14162 ERs |

## SECTION A. Description of project activity
### A.1. Purpose and general description of project activity

The purposes of this project activity are:

(1) To reduce GHG emissions by introducing an energy efficient brick making technology to manufacture FaL-G (fly ash-lime-gypsum) bricks and blocks as alternative building materials to the commonly used burnt clay bricks, which use fossil fuel for their production;
(2) To reduce air pollution by avoiding the use of fossil fuel; and
(3) To enhance the use of fly ash, an industrial by-product, as an ingredient of building material.

Burnt clay bricks are predominantly used as walling material by the construction sector in India. The process of producing these bricks involves consumption of fossil fuel and denudation of fertile topsoil. FaL-G bricks and blocks are alternative building materials to the traditional burnt clay bricks and are substitutes to the traditional burnt bricks used for construction. Production process of FaL-G bricks and blocks does not involve sintering and thus completely eliminates the burning of fossil fuels as required in the clay brick production, ultimately contributing to the reduction of greenhouse gas emissions.

This Project Design Document is applicable to the 14 FaL-G plants that have been set up at various locations in the state of Andhra Pradesh since January 2003.

Each FaL-G plant qualifies as a small scale CDM project as per the definition of small scale CDM projects contained in Appendix B to the simplified modalities and procedures for small scale projects. In order to reduce the transaction cost, a bundling approach is being followed in compliance with the rules prescribed by the Executive Board for bundling small scale projects.

**Contribution to Sustainable Development**

The project promotes an eco-friendly technology for production of alternative building materials. By avoiding use of fossil fuel in the production process, the project contributes to conservation of energy and fossil fuel (coal). By displacing burnt clay bricks in the walling materials market, the project contributes to protect the environment by minimising eco-hostile activities such as topsoil denudation leading to land degradation and air pollution caused by emission of unprocessed flues. Furthermore, since the alternative building material is manufactured using industrial wastes and byproducts as raw materials, the environmental impacts associated with improper disposal of such industrial wastes are also mitigated by the project. On social front, the project creates business opportunities for the small and micro enterprises. In contrast to the seasonal production-operations in the clay brick industry, FaL-G plants have the advantage of continuous year-wide operation, and hence provide yearlong employment opportunity for the skilled artisans and create self-help livelihood opportunities for the illiterate poor. The intrinsic environmental and social benefits of the project are further enhanced by a specific community benefit program, particularly the health and accident insurance schemes that are implemented to meet the requirements of the Community Development Carbon Fund (CDCF) of the World Bank. The project thus contributes to sustainable development in many ways.

**A.2. Location of project activity**

**A.2.1. Host Party(ies)**

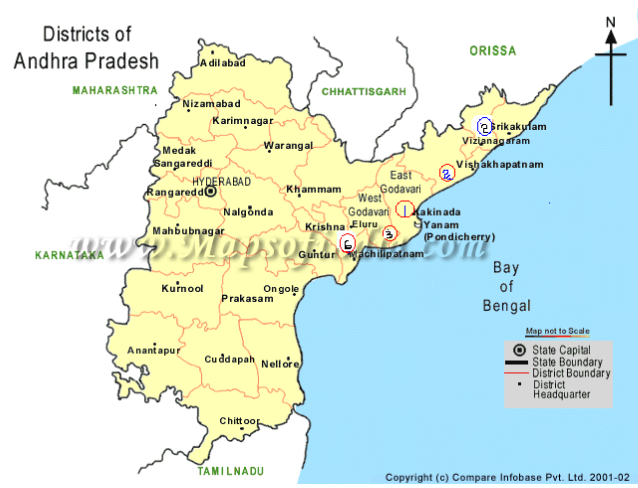
India

**A.2.2. Region/State/Province etc.**

Different districts in the State of Andhra Pradesh, India, as shown in the geographical map below.

## Geographical Location of Andhra Pradesh (Red boundary)


### State of Andhra Pradesh & District wise FaL-G plants



**Location of FaL-G plants in the first bundle**:

| <u>Name of District</u> | <u>Number of plants</u> |
|---|---|
| Krishna | 6 |
| West Godavari | 3 |
| East Godavari | 1 |
| Visakhapatnam | 2 |
| Vizianagaram | 2 |

**A.2.3. City/Town/Community etc.**

The clusters and cities in which the project activities implemented are as follows.

| States | District | No. of Plants | Aggregate Capacity - $m^3$/year |
|---|---|---|---|
| Andhra Pradesh | Krishna | 6 | 27000 |
| | West Godavari | 3 | 12600 |
| | East Godavari | 1 | 3600 |
| | Visakhapatnam | 2 | 9000 |
| | Vizianagaram | 2 | 9000 |
| Total | | **14** | **61200** |

The capacities of plants have been independently shown in Appendix 8.

**A.2.4. Physical/ Geographical location**

The FaL-G plants are located in those clusters and geographical areas, which are characterised by easy availability of the key raw materials such as fly ash, gypsum and stone dust, and also proximity to the brick markets. A typical FaL-G plant is located near an urban growth centre where brick demand exists. Each plant requires at least a 2000 square meters of land. The plants included in the project are identified by a unique code/serial number for records and administrative convenience. The code consists of identity of the State, followed by identity of the district, Bundle No. in roman, and Serial Number of the plant in that bundle. For example, the ninth Plant in bundle No. I in the state of Andhra Pradesh in West Godavari District is represented by the code:  AP/WG/I/9.

**A.3. Technologies and/or measures**

The activity proposed in the project falls under type II – Energy Efficiency Improvement Projects. The FaL-G brick/block plant completely avoids the sintering process and associated coal consumption. Some of the machines in a FaL-G plant require either electricity or diesel for their operation. The consumption of such forms of energy (diesel or electricity) however is much lower compared to the thermal energy consumed for production of burnt clay bricks. The project activity thus falls under Type II.D. “Energy efficiency and fuel switching measures for industrial facilities”.

Clay brick manufacturing involves two key processes: i) producing green bricks (clay bricks before firing are called ‘green bricks’), and ii) sintering/firing the green bricks in a kiln. The sintering process requires thermal energy inputs. Production of FaL-G bricks and blocks in contrast, does not involve any thermal

energy inputs. Significant amount of thermal energy is therefore saved through the use of FaL-G technology. The mechanical equipments/machineries used in a FaL-G plant use electricity or diesel. But the amount of such energy consumed is much lower compared to the thermal energy used in production of clay bricks, resulting in substantial energy savings in brick manufacturing. Type II, and category II.D. is therefore considered appropriate[1] for the project activities.

The total amount of energy saving to be achieved by the project is estimated as the difference between the energy consumed for production of certain volume ($m^3$) of bricks and blocks produced in the project and the energy that would have been consumed for production of an equal volume of clay bricks.

The aggregated energy saving by the 14 FaL-G plants included in the project, with an aggregated production capacity of 61200 $m^3$ bricks/year, is estimated to be about 43.73 $GWh_{th}$ per year. This saving is below the 45 $GWh_{th}$ thresholds for savings in thermal energy inputs for small scale projects falling into II.D category.

**The Technology**

The FaL-G technology, used in the project to produce FaL-G bricks and blocks, is invented in the host country by the Institute of Solid Waste Research and Ecological Balance (INSWAREB). The technology works with the strength of fly ash, lime and gypsum chemistry. The slow chemistry of fly ash and lime is maneuvered by tapping ettringite phase to its threshold limits through sufficient input of gypsum. Therefore, FaL-G does not require energy intensive equipments such as heavy duty-press or autoclave, which are otherwise required in case of only fly ash and lime. The FaL-G process completely eliminates the thermal treatment, and does not require combustion of any fossil fuel.

The key ingredients of the FaL-G products are fly ash, lime, and gypsum, which are well-known mineral substitutes. All these materials are available in the form of wastes and byproducts from industrial activities and are available in adequate quantities in the areas, where the project activities are located.

FaL-G technology is developed in two approaches, viz. “FaL-G in lime route” and “FaL-G in OPC route”. The patent specifications on FaL-G cover both the approaches. Though FaL-G technology was primarily developed using lime, OPC was also identified as a source of lime to facilitate pozzolanic reactions in FaL-G system. . These approaches have significant bearing on technical point of view. INSWAREB has classified fly ash in to two varieties based on the sintering temperatures of coal in thermal plants and boilers. They are LT (low temperature) fly ash and HT (high temperature) fly ash. The research at INSWAREB established that LT fly ash goes well with lime where as HT fly ash goes well with OPC (pp. 28-30 Fly ash for Sustainable Development, the book authored by Dr Bhanumathidas and Kalidas; 2002). However in both the fly ashes either of the routes is interchangeable depending on the logistics of raw material availability and economics. This made the technology more flexible and adopt-friendly.

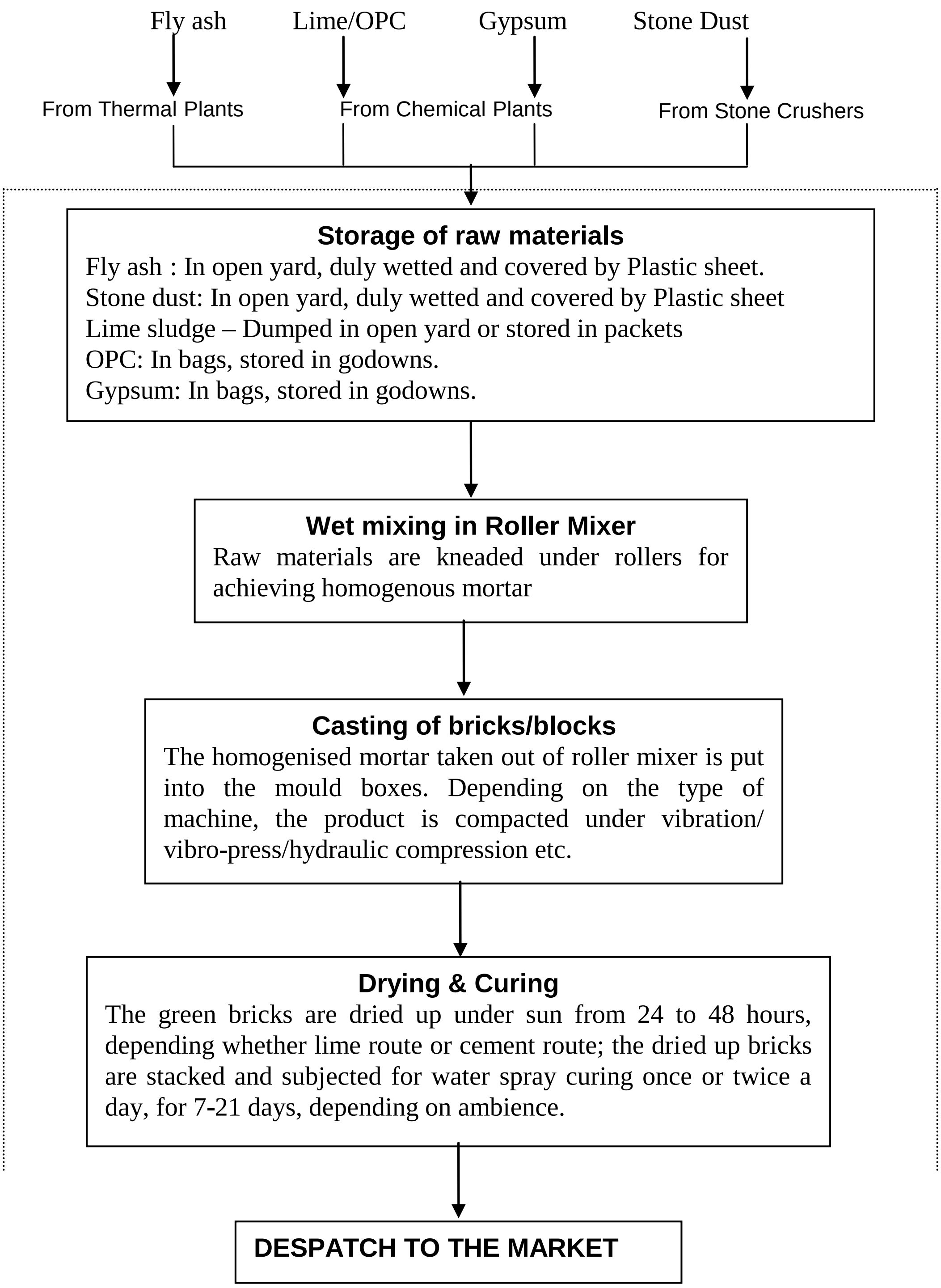
Byproduct lime is available at almost 1/10$^{th}$ to 1/3$^{rd}$ of the mineral lime cost. Otherwise, it is economical to use OPC than mineral lime and, hence, OPC is preferred in areas where byproduct lime is scarce or not available due to profuse FaL-G activity. . In view of quality and logistical issues in procuring lime many entrepreneurs adopt FaL-G in OPC route.

The following table gives the raw material inputs for a typical plant capacity of 4,500 $m^3$/year.

[1] The appropriateness of the category has been confirmed by the Small Scale Working Group (SSCWG) in response to the project participants’ proposal to use a new category under category III. Recommendations of the SSCWG on the subject is provided at Appendix 9.

| **Ingredients** | **Lime route** | | **OPC route** | |
|---|---|---|---|---|
| Weight ratio | % | tons | % | tons |
| Fly ash | 15 | 1350 | 15.2 | 1368 |
| Lime | 7.5 | 675 | -- | -- |
| OPC | -- | -- | 4.0 | 360 |
| Gypsum | 2.5 | 225 | 0.8 | 72 |
| Filler (aggregate) | 75 | 6750 | 80 | 7200 |

The schematic FaL-G process is provided in a chart below.


Fly ash
Lime/OPC
Gypsum
Stone Dust
From Thermal Plants
From Chemical Plants
From Stone Crushers
Storage of raw materials
Fly ash : In open yard, duly wetted and covered by Plastic sheet.
Stone dust: In open yard, duly wetted and covered by Plastic sheet
Lime sludge – Dumped in open yard or stored in packets
OPC: In bags, stored in godowns.
Gypsum: In bags, stored in godowns.
Wet mixing in Roller Mixer
Raw materials are kneaded under rollers for achieving homogenous mortar
Casting of bricks/blocks
The homogenised mortar taken out of roller mixer is put into the mould boxes. Depending on the type of machine, the product is compacted under vibration/ vibro-press/hydraulic compression etc.
Drying & Curing
The green bricks are dried up under sun from 24 to 48 hours, depending whether lime route or cement route; the dried up bricks are stacked and subjected for water spray curing once or twice a day, for 7-21 days, depending on ambience.
DESPATCH TO THE MARKET

INSWAREB is the technology source and already the practice is in vogue to train the entrepreneurs as well as their production personnel while transferring the technology.

The role of INSWAREB, as mentioned in B.4 and B.7.3 of PDD, is to determine the baseline and Monitoring methodology. Thus INSWAREB would impart training to the monitoring personnel of ECPL. It has already been informed that there are Board minutes on both sides (Eco Carbon Pvt. Ltd, the Project Entity and INSWAREB, technology promoter) to cover these activities and to have mutual cooperation. A suitable agreement between INSWAREB and ECPL would be signed once the PDD and subproject agreements are finalised.

**A.4. Parties and project participants**

| Party involved (host) indicates a host Party | Private and/or public entity(ies) project participants (as applicable) | Indicate if the Party involved wishes to be considered as project participant (Yes/No) |
|---|---|---|
| Government of India (Host) | Eco-Carbon Private Limited (ECPL), on behalf of individual entrepreneurs listed in Appendix 8. | No |
| Government of Italy | International Bank for Reconstruction and Development as the Trustee of the Community Development Carbon Fund (CDCF) | Yes |
| Government of The Netherlands | International Bank for Reconstruction and Development as the Trustee of the Community Development Carbon Fund (CDCF) | Yes |
| (*) In accordance with the CDM modalities and procedures, at the time of making the CDM-PDD public at the stage of validation, a Party involved may or may not have provided its approval. At the time of requesting registration, the approval by the Party(ies) involved is required. | | |

**Eco Carbon Pvt. Ltd. (ECPL):** A private company, which is committed for promoting FaL-G technology as CDM activity on commercial principles. ECPL will provide the technological and operational support to the individual entrepreneurs for implementing the FaL-G plants. ECPL represents the individual entrepreneurs and is responsible for organising the entrepreneurs in order to promote the project activities for carbon transactions.

**The Community Development Carbon Fund (CDCF):** Trust fund maintained and operated by the World Bank in its capacity as trustee of the CDCF on behalf of the public and private participants. CDCF will purchase the emission reductions generated by the project from ECPL and supervise the implementation of community benefit program.

The official contact for the CDM project activity is the Community Development Carbon Fund (CDCF) of the World Bank.

**A.5. Public funding of project activity**

No public funding from Parties included in Annex 2 is being received by this project as confirmed vide Appendix 2.

**A.6. Debundling for project activity**

The project activity is not a debundled component of a larger project activity as defined in appendix C to the simplified M&P for the small-scale CDM project activities. There are no other project activities registered or applying for registration as small-scale CDM projects with the same project participants and in the same project category and technology/measure (FaL-G). All the FaL-G plants included in the project are independently owned and operated by different entrepreneurs.

The characteristics of the individual FaL-G plants are provided below.

(i) Each FaL-G plant is independently owned and operated;
(ii) The FaL-G plants use same technology disseminated from the technological source, INSWAREB, acting as an intermediary; but have independent and one to one technological tie up with INSWAREB. Thus, each FaL-G plant enjoys the technical support of INSWAREB under norms of technology counselling.
(iii) Each FaL-G plant signs the Sub-Project Agreement with Project Entity, committing to transfer specified quantity of ERs during the project period.
(iv) No contractual arrangements exist among the bundled FaL-G plants.
(v) Each plant would be catering to different market segments, depending on transport, commercial and other logistical constraints; and
(vi) Each plant has specific boundary delineated by the physical and geographical site and equipments employed.

**SECTION B. Application of selected approved baseline and monitoring methodology**
**B.1. Reference of methodology**

Type II – Energy Efficiency Improvement Projects

Type AMS II.D. Energy efficiency and fuel switching measures for industrial facilities. Version 07, 28 November 2005.

For new facilities, the approved methodology requires the following.

1. Metering the energy use of the equipment installed
2. Calculating the energy savings due to the equipment installed or alternate technology adopted

**B.2. Project activity eligibility**

The project category applied to this project activity is as follows:

- TYPE II - Energy Efficiency Improvement projects
- Category: II.D. Energy efficiency and fuel switching measures for industrial facilities.

The approved methodology AMS-II.D states that activities involving efficiency measures for specific industrial processes (such as steel furnaces, paper drying, tobacco curing etc.) do fall into the II.D. category. It also states that the measures may replace existing equipment or be installed at new facilities.

Manufacturing of burnt clay bricks is an industrial activity, which requires thermal energy inputs for the purpose of sintering. Fossil fuel and/or biomass are primarily combusted to provide the required amount of thermal energy for sintering the clay bricks, which results in $CO_2$ emissions. Production of FaL-G bricks and blocks however do not require combustion of fossil fuels or biomass as the FaL-G technology does not require any sintering. Instead, the strength is achieved through chemical reactions between the selected raw materials used, viz. fly ash, lime, gypsum and water. The products are then just air and/or solar dried and water cured for a specific period (curing time) to achieve the desired strength. The use of thermal energy from fossil fuels or biomass is completely avoided in the process. FaL-G plants are run either on electricity or on diesel. Consumption of such forms of energy (diesel or electricity) however is much lower compared to the thermal energy consumption for production of clay bricks. Use of AMS II.D is therefore considered appropriate[2].

The project introduces energy efficiency measure in form of FaL-G technology in brick making. The measure is introduced at 14 new brick production facilities. With full capacity utilization, the total energy savings to be achieved from the project is estimated to be about 43.73 $GWh_{th}$ per year. This saving is less than the threshold of 45$GWh_{th}$ per year applicable to this category of activities as defined in AMS II.D. The activity proposed thus meets all the conditions to use the methodology provided in AMS II.D.

**B.3. Project boundary**

In line with the definition for type II.D methodology, the boundary for the purpose of the proposed project is defined as the physical, geographical area affected by the project activity. Accordingly, the boundary of the project is defined to include the physical and geographical limits of the FaL-G plants included in the project, and shown in the process flow chart. The production sites typically include the following facilities:

- The storage yard for raw materials.
- Pan mixer for mortar preparation
- Casting machine
- Drying yard (natural drying in ambient temperature)
- Curing yard (water spray curing in ambient temperature)

The only source of $CO_2$ emission that occur within the project boundary is the $CO_2$ emission associated with consumption of diesel, where the mechanical equipments are run by diesel engines. In such cases

[2] The appropriateness of the category has been confirmed by the Small Scale Working Group (SSCWG) in response to the project participants' proposal to use a new category under category III. Recommendations of the SSCWG is on the subject is provided vide Appendix 9.

diesel is burnt directly in the engine (not converted to electricity) to run the mechanical equipments such as the pan mixer. Wherever electricity is available the same is used to run the equipments. Emissions associated with the consumption of diesel and electricity are accounted for while estimating the emission reductions. The only other activity outside the project boundary that leads to $CO_2$ emissions is the transport of raw materials to the FaL-G plants. Since substantial transport activity (for soil and coal) also occurs in the baseline to support clay brick activity (the baseline activity), as well as to support waste disposal activity (for various kinds of wastes - fly ash, gypsum etc.), emissions associated with transport of raw materials is not included in the project emissions.

**B.4. Establishment and description of baseline scenario**

**As per AMS II.D.** "the energy baseline consists of the energy use of the existing equipment that is replaced in the case of retrofit measures and of the facility that would otherwise be built in the case of a new facility".

The project involves setting up new facilities for production of bricks and blocks by using the FaL-G technology, which is energy efficient. The energy baseline is therefore the energy use of the facilities that would otherwise be built in the absence of the project in order to meet the demand for walling material, comparable in quality and utility to that of bricks and blocks produced through FaL-G technology. The data on walling material market (provided in table 1.2) shows that burnt clay bricks represent more than 95% of the total walling material market. Production of burnt clay bricks is therefore considered the baseline scenario.

**Energy Baseline**

Based on the justifications provided in the previous paragraph, energy use of burnt clay brick making facilities is considered the energy baseline.

Production of burnt clay bricks employs different technologies with different levels of energy consumption. Since it is difficult to determine precisely a particular technology that would be used in the absence of project activity, a weighted average energy use of these technologies is considered to best represent the baseline energy consumption. The technologies, which are banned by regulation, have not been considered in calculating the weighted average energy use.

The different technologies that are used to produce burnt clay bricks include clamps, Movable Chimney Bull Tranche Kilns (MCBTK), Fixed Chimney Bull Tranche Kiln (FCBTK), High Draft Kilns (HDKs) and the recently introduced Vertical Shaft Brick Kiln (VSBK) technology. Concerned over the increasing pollution from brick industry, the Government of India has already banned the use of MCBTK and it does not issue any clearances/approvals to set up new brick units using MCBTK. Therefore, MCBTKs have not been considered in the energy baseline. The energy baseline (energy use for production of unit volume of bricks/blocks) is determined by considering the remaining technologies and their prevalence in the market using the data presented in the table 1.1 below. (source[3] : Emission Standards for brick kilns- An opportunity for Technology upgradation by Sameer Maithel, The Energy Research Institute (TERI), India)

[3] http://www.brickindia.com/articledetail.asp?id=36&cat=5

**Table 1.1 : Energy consumption of different types of brick kilns in India**

| Burnt clay brick technologies | Specific energy consumption (MJ/kg-brick) SECx | | Production capacities (100000 kg - bricks/year ) Qx | | No. of Plants Nx |
|---|---|---|---|---|---|
| | Range | Average | Range | Average | |
| BTK- fixed chimney | 1.0 – 1.5 | 1.25 | 83 - 275 | 179 | 25000 |
| High draft/ zig zag | 0.8 – 1.0 | 0.9 | 83 - 138 | 110 | 200 |
| Clamps | 2.0 – 3.0 | 2.5 | 1.4 – 27.5 | 14 | 60,000 |
| Vertical Shaft Brick Kiln | 0.8 – 1.0 | 0.9 | 14 - 110 | 62 | 30 |

The weighted average specific energy for burnt clay brick is thus calculated by using the following formulae.

$$SEC_{claybrick} = \frac{\sum_{x} SEC_x \bullet Q_x \bullet N_x}{\sum_{x} Q_x . N_x}$$

Where
$SEC_{clay\ brick}$ = Weighted average specific energy of clay brick (MJ/kg-brick)
$SEC_x$ = Specific energy of brick produced using technology x (MJ/kg)
$Q_x$ = Production capacity of brick plants using technology x (100000 kg-bricks/year)
$N_x$ = No.of plants that use technology x in the country
X = different types of technologies

The weighted average energy consumption figure for clay brick production using the above equation and the data presented above works out to be 1.45 MJ/kg-brick. Considering the popularly practiced dimensions of length, breadth and height of burnt clay brick to be 22 cm, 10 cm, and 7 cm respectively, and weight of the brick to be approximately 2.77 kg/brick (at 1800 kg/$m^3$) the specific energy consumption translates to be 0.00261 TJ/$m^3$bricks.

**Emission Baseline**

Coal is the main source of energy used for manufacturing burnt clay bricks in India. The second choice of fuel is biomass, including fuel wood. In one of the studies undertaken by the FAO[4] the annual use of fuel wood in the entire brick industry in the country is reported to be only 300,000 tons, while the use of coal is reported to be about 14,000,000 tons. Thus use of fuel wood represents less than 2% in terms of energy inputs of the total energy requirement of the brick industry in all of India. Since the values reported in the FAO report do not distinguish between the renewable biomass and nonrenewable biomass, the actual fraction of renewable biomass (with zero emissions) is likely to be lower. Further the situation with biomass, which was earlier available as a cheaper fuel, is changing rapidly nationwide. The on going initiatives for biomass-based power plants have introduced competition in the market, increasing the cost of biomass. In the absence of any precise information on the use of biomass in brick

[4] Source: FAO Field Document No. 35, “Regional Wood Energy Development Programme in Asia”, GCP/RAS/154/NET.

industry, it is proposed to fix the biomass usage in brick production conservatively at 5% of the total energy input, for all the areas included in the project. This figure is higher than the national average figure of less than 2% reported in the FAO report. In order to account for the zero emissions from the use of biomass, the energy use in burnt clay brick production is adjusted appropriately by multiplying it with a "biomass adjustment factor" (0.95 = 1 - 0.05). The baseline emission thus derived would be conservative.

The amount of $CO_2$ emissions from burning of coal depends largely on the type of coal and its calorific value. Different types of coal are used in India for brick making. In order to address the variability in coal quality, the IPCC default carbon emission factor for Indian coal as 25.8 tC/TJ (IPCC) has been used to estimate the CO2 emissions associated with burning of coal in the baseline.

The total gross emissions from the baseline scenario are estimated to be 15110.65 tonnes of $CO_2$ equivalent per annum for the 14 plants included in the project. For details refer section B.6.3.

**Date of Completion of the baseline :** 5th April 2006.

**Name of person/entity determining the baseline:**

Institute for Solid Waste Research & Ecological Balance
FaL-G Mansion
35. Shri Venkateswara Colony
Visakhapatnam 530012

Name of Contact person:
N Kalidas
Phone: ++91-891-2516411
Fax: ++91-891-2517429
Mobile: ++91-98481-91453

The entity, Institute of Solid Waste Research and Ecological Balance is not a project participant.

**B.5. Demonstration of additionality**

A small scale CDM project activity is additional if anthropogenic emissions of greenhouse gases by sources are reduced below those that would occur in the absence of the registered project activity, and the project activity is facing one or more barriers as defined in Attachment A to Appendix B of the simplified modalities and procedures for small scale CDM project activities.

The analysis in the following paragraphs documents a number of barriers for the FaL-G technology. It is expected that the burnt clay brick manufacturing using conventional technologies will continue to meet the walling material demand in the country resulting in substantial $CO_2$ emissions, in the absence of the project activity. The project activity is therefore considered additional and would result in emission reductions below those that would have occurred if the equivalent amount of clay bricks were to be produced.

**Barrier due to prevailing practice**

Burnt clay bricks continue to be the most popular form of walling material in the country as it is cheap and has traditionally been believed to be the most suitable walling material for building construction.

Although alternative building materials such as cement concrete block and fly ash bricks have been introduced in the recent past, burnt clay bricks account for more than 95% of the total market for walling material in larger parts of the country. This can be seen from the data presented below (Source : A study on "Cost Effective Building Materials & Technologies" undertaken by Holtec Consulting Private Limited in the year 2004 on behalf of Building Materials Technology Promotion Council, a Government of India Undertaking).

**Table 1.2 : Market share of different walling materials**

| Type of walling material | Market size (Rs. Crores[5]) | % of total market |
|---|---|---|
| Burnt clay bricks | 32825 | 95.3 |
| Cement Concrete Blocks | 1135 | 3.3 |
| Fly ash bricks incl. FaL-G | 485 | 1.4 |
| Total | 34445 | 100 |

Clay brick production is a simple activity and is even practiced at the cottage sector level. Clay brick is a commonly used technological practice, which, even at the brink of 21st century, is practiced as a family trait that has been passed on from generation to generation. Small fired clay brick producers have no incentives to introduce alternate technologies, which require new investments, training to stabilize the operation, and a different business practice in long term perspective. Production and use of burnt clay bricks is therefore considered to be the most common practice at present and is expected to remain a common practice in the future unless significant regulatory mechanisms are evolved and enforced.

**Technological Barriers**

FaL-G technology in particular, requires a recipe control of 3 main ingredients namely fly ash, lime/cement and gypsum plus water at the mixing step. This is followed by manual/mechanical casting and lining up the bricks on the platform or casting yard for drying for one or two days. The dried up bricks are stacked and cured with water for one to two weeks, depending on the ambient temperature upon which the product is ready for despatching to the market.

FaL-G is a proven technology and has superiority in terms of the strength as a walling material. However, it requires building the capacity of the entrepreneurs and training of artisans to start up and maintain the production. These requirements are perceived as barriers by the burnt brick manufacturers.

Two important technical features that have led to high risk perception of FaL-G are discussed below.

***Sourcing of raw material*** **:** In contrast to the clay brick industry, where the basic raw material is the soil available in and around the production sites, FaL-G technology and products require fly ash, lime and gypsum as key ingredients. These ingredients are required to be tested, selected and sourced from industrial facilities, where they are produced. FaL-G Plants are therefore required to be carefully located unlike the traditional clay brick plants, which require only the supply of adequate amount of soil.

***Operating within the specified limits for right chemistry*****:** FaL-G technology, unlike the traditional clay brick making, requires recipe control of 3 main ingredients namely fly ash, lime/cement and gypsum plus water at the mixing step. In case there are changes to the sources of the raw materials, the chemistry and hence the recipe needs to be reworked. This is perceived as an interruption to plant operation leading to production loss.

[5] 1 crore = 10 million

**Other barriers: Market acceptance of FaL-G products**

In spite of the various superiorities of the FaL-G brick, the grey color (imparted by the color of fly ash) of FaL-G products creates a barrier in terms of low consumer acceptance. This is the common observation made by consumers during various market surveys conducted by different FaL-G brick promoters. In addition to the colour, the presence of ash in the product also creates negative perception on the quality of the product.

### B.6. Emission reductions

### B.6.1. Explanation of methodological choices

The activities envisaged in the project are similar to those covered under the approved methodology AMS II.D, version 07. The new FaL-G plants that are set up in the project consume lower energy to produce an equivalent output of bricks and blocks compared to the production of burnt clay bricks in clay brick plants. The project thus contributes to energy saving. The approved methodology requires the energy consumption in new facilities to be monitored through metering. This is possible in FaL-G plants, where electricity is used as the main source of energy. For FaL-G plants where diesel is used as the main source of energy, it is possible to estimate the energy consumption by recording the diesel consumption.

The approved methodology AMS II.D requires the total energy savings of the project to be below 15 $GWh_e$ or 45 $GWh_{th}$. The energy saving to be achieved by the 14 FaL-G plants included in the project is estimated to be about 43.73 $GWh_{th}$.

The choice of the methodology AMS II.D, version 07, 28 November 2005 is thus appropriate.

**Estimation of Project emissions:**

The approved methodology II.D requires each form of energy used to be multiplied with corresponding emission coefficient (kg-$CO_2$ equ/KWh) to determine the $CO_2$ emissions. Different forms of energy used in a FaL-G plant include either electricity or diesel. Wherever electricity is available, the same is used in the plant. In places, where electricity is not available diesel is used to run the plant. Therefore in a given plant either electricity or diesel is used as the source of energy not both. The emission coefficient of electricity and diesel are therefore used to estimate the project emissions.

Estimating emissions from electricity consumption

For those plants, which run on electricity, the project emissions are calculated using the formulae

$$E_{p,x} = E_{x,elec} = (Q_{x,FALG} \times SEC_{x,FALG}) \times EF_{elec}.$$

$$Q_{x,FALG} = Q_{x,bricks} + Q_{x,blocks}$$

$$SEC_{x,FALG} = Q_{x,elec} / Q_{x,FALG}$$

$E_{p,x}$ = Project emissions for plant x ($tCO_2$/year)
$E_{x,elec}$ = Annual $CO_2$ emissions from a plant x associated with annual consumption of electricity ($tCO_2$/year)
$Q_{x,FALG}$ = Annual production of FAL-G bricks/blocks from the plant x ($m^3$/year)
$Q_{x,brick}$ = Annual production of FaL-G bricks in plant x ($m^3$/year)
$Q_{x,block}$ = Annual production of FaL-G blocks in plant x ($m^3$/year)
$SEC_{x,FALG}$ = Specific energy consumption of FaL-G product in plant x ($KWh_e/m^3$)

$Q_{x, elec}$ = Annual consumption of electricity in the plant x ($KWh_e$/year)
$EF_{elec}$ = Emission factor of electricity ($tCO_2$/KWhe)

Estimating emissions from diesel consumption

Wherever electricity supply is not available, diesel is used to run the equipments and machineries in the plant. Consumption of diesel in the plant is monitored and recorded on a monthly basis, from which the annual consumption is calculated. Emission associated with such consumption of diesel is calculated by multiplying the quantity of diesel consumed with the IPCC emission factor for diesel. The project emission is thus represented by the formulae

$$E_{p,x} = E_{x,diesel} = Q_{x, FaLG} \times SEC_{FALG} \times EF_{diesel}$$

$$SEC_{x,FALG} = Q_{x, diesel}/Q_{x, FALG}$$

Where,

$Ex_{diesel}$ = $CO_2$ emissions due to direct consumption of diesel in the plant x ($tCO_2$/year)
$SEC_{x\ prod}$ = Specific energy consumption of FaL-G product in plant x (litre/$m^3$)
$Q_{x\ diesel}$ = Quantity of diesel used in the plant x per year (litres/year)
$EF_{diesel}$ = $CO_2$ emission factor for diesel (tCO2/litre), IPCC default value

The total project emissions $E_p$ due to the project activities within the project boundary is represented by the formulae

$$E_p = \sum_x E_{p,x}$$

**Estimation of Emissions due to leakage:**

According to II.D., leakage consideration is applicable if the energy efficient technology is equipment transferred from another activity or the existing equipment is transferred to another activity. None of these occur in the project. Therefore, leakage calculation is not applicable for this project.

**Total Project activity emissions:**

Since no leakage is considered for the project, the total project emissions within the project boundary $E_p$, represents the total project activity emissions.

**Estimation of Baseline emissions:**

Baseline Emissions are computed based on production of bricks and blocks in terms of $m^3$. In order to make the claim more diligent and conservative, lowest production value ($QL_{x, FaL-G}$) is derived based on three approaches as discussed below. For this purpose, as referred in D4, fly ash (as raw material) is taken as one of the basis and electricity as the other basis.

$Q_{rec}$ = Quantity (volume) based on production records
$Q_{fa}$ = Quantity (volume) based on fly ash utilisation
$Q_{elec}$ = Quantity (volume) based on electricity consumption.

In certain units machines are run with diesel, partially or totally, and hence production is monitored based on diesel also, ie.,

$Q_{diesel}$ = Quantity (volume) based on diesel consumption

The data on $Q_{elec}$ and $Q_{diesel}$ have been derived based on normal operational efficiency as studied in the field and tabulated vide Appendix 10. Any increase in man power efficiency is bound to decrease the consumption of Electricity/diesel, and thus the given data is proved to be conservative. In case the man power number or efficiency comes down, the labour stop working because they are paid by piece rate and thus their earnings are directly linked to output. For example, during summer, the labour generally do not work during 10:00 to 16:00 hrs for fall of efficiency and, in turn, the output that effects their earnings. Moreover, with decreased efficiency the SPE will not operate the unit on economic considerations.

Based on Fly ash consumption:

Based on the fly ash input in total FaL-G mix practiced at each SPE, specific consumption factor of fly ash is arrived in terms of %. The procurement of fly ash, duly supported by inward challans/ weighment data, is the total consumption of fly ash. Thus 'Production based on fly ash consumption ($Q_{fa}$)' is computed as follows:

$Q_{fa}$ is calculated as: $Fa_{con}/Sp.C_{fa}$

where $Fa_{con}$ = total fly ash consumption of unit x for the corresponding year

$Sp.C_{fa}$ = Specific Consumption factor of fly ash of the unit x.

Specific consumption factor of fly ash is derived based on the mix proportions declared by SPE at the time of enrolment into the project. For any reason, if the SPE changes the composition, he is advised to report the changed mix proportions to PE for carrying our necessary changes in the data bank. During inspection visits to the units, the Carbon Inspectors recheck the mix and record the changes, if any. Without recorded data, if there is conflict of data noticed at site during inspection, the conservative (higher) mix content will be taken that results in lower quantity of production based on fly ash. SPEs are visited once in 6 months, at any month. If there is a change in input ratio, the same is recorded and changed in our data bank.

There is no specific quality management procedure except the strength certificate.

Based on electricity consumption:

The specific power consumption for each SPE, vide Appendix 10, is arrived based on the following approach:

- The label capacities of motors have been recorded from each plant for computation purpose.

- Based on the output in the field, the power factor has been arrived.

The observation is output Vs power consumption, based on which power utilisation factor was

arrived.

- A power factor of 0.40 means a plant with aggregated load of motors at 10HP records to consume

4 HP power/hour based on the loads applied on it for varied durations in a given operational time.

Output/hour is as studied in the field and arrived on conservative basis.

This is a one-time study at the beginning, and data is used as ex-ante fixed data.

Thus certain typical types of plants were identified and noted of their specific power consumption on $m^{3.}$ basis, which formulate as the factor for computation of production and, in turn, for ERs. All the plants fall in one of these categories as described below:

| Nature of Machinery | Type I | HP | Type II | HP | Type III | HP | Type IV | HP | Type VII | HP |
|---|---|---|---|---|---|---|---|---|---|---|
| Pan Mixer | Gear box | 5.0 | Gear Box | 5.0 | Bevel gear | 7.5 | Diesel driven bevel gear vibro press combined | 10.0 | Gear Box | 5 |
| Casting Machine | Egg-laying manual | 1.5 | Egg-laying hydraulic | 5.5 | Vibro-press manual | 2.0 | | | Rotary hydraulic press and conveyor | 18 |
| | | 6.5 | | 10.5 | | 9.5 | | 10.0 | | |
| Specific consumption factor kWh/$m^3$ | | 1.2 | | 1.2 | | 1.54 | Specific consumption factor Diesel ltr/$m^3$ | 1.0 | | 2.4 |

$Q_{elec}$ is calculated as: $Elec_{con}/Sp.C_{elec}$

Where $Elec_{con}$ = total electricity consumed by unit x for the corresponding year

$Sp.C_{elec}$ = Specific consumption factor of electricity of the unit x, vide table above, as fixed ex ante.

<u>Based on diesel consumption:</u>

The diesel consumption is monitored based on the study undertaken to record diesel consumption Vs. output.

Production based on diesel consumption ($Q_{diesel}$) is computed as follows, wherever diesel is used as an alternate to electricity, totally or partially.

$Q_{diesel}$ is calculated as: $Diesel_{con}/Sp.C_{diesel}$

Where $Diesel_{con}$ = total diesel consumed by unit x for the corresponding year
$Sp.C_{diesel}$ = Specific consumption factor of diesel of the unit x, vide table above, as fixed ex ante.

For baseline emissions based on lowest production value:

The emissions $E_{b,x}$ from the baseline activity for the plant x is calculated as

$$E_{b,x} = (1 - PER_{biomass}) \bullet SEC_{claybrick} \bullet QL_{x,\ FALG} \bullet CEF \bullet CC$$

where,

$PER_{biomass}$ = biomass correction factor for the baseline = 0.05

$SEC_{clay\ brick}$ = Specific energy consumption of burnt clay bricks (MJ/$m^3$ clay brick)

$QL_{x,\ FALG}$ = Quantity(Volume) of clay bricks ($m^3$/year) equal to that of lowest quantity of FaL-G bricks and blocks in plant x ($m^3$ clay bricks/year) as arrived by three comparative approaches as explained above.

CEF = Carbon Emission Factor for fuel used (bituminous coal) 25.8 tC/TJ (IPCC default value for India)

CC = Carbon to $CO_2$ conversion factor

The total emissions $E_b$ in the baseline is represented by the formula

$$E_b = \sum_x E_{b,x}$$

With 14 plants in the project, the net baseline scenario is 143550 tonnes of $CO_2$ over 10 years assuming a production capacity of 61,200 $m^3$ FaL-G bricks/blocks per year.

**Estimation of Emission Reductions:**

Emission reduction generated by the project consisting of 14 plants (x=14) is represented by the formula

$$ER = \sum(E_{b,,x} - E_{p,.x})$$

### B.6.2. Data and parameters fixed ex ante

| | |
|---|---|
| **Data / Parameter** | **$EF_{diesel}$** |
| **Unit** | t $CO_2$/ litre |
| **Description** | Emission of diesel is derived directly out of diesel procured, using default values. |
| **Source of data** | IPCC default value |
| **Value(s) applied** | 0.0032 ton $CO_2$/litre |
| **Choice of data or Measurement methods and procedures** | This value has been taken in accordance to the provisions of approved methodology for Type II, II D., which facilitates to use IPCC default values vide clause 4 of Baseline in II.D. |
| **Purpose of data** | To compute project emissions. |
| **Additional comment** | Default values provide for conservative estimates. |

| | |
|---|---|
| **Data / Parameter** | $EF_{elec}$ |
| **Unit** | t $CO_2$/mWh$_e$ |
| **Description** | Emissions of electricity are derived directly out of power consumption using default values. |
| **Source of data** | IPCC default value |
| **Value(s) applied** | 0.9 t $CO_2$/mWh |
| **Choice of data or Measurement methods and procedures** | This value has been taken in accordance to the provisions of approved methodology for Type II, II D., which facilitates to use IPCC default values vide clause 4 of Baseline in II.D. |
| **Purpose of data** | To compute project emissions. |
| **Additional comment** | According to statistics, the power generation through thermal + gas comes to around 56-60% either in a state or in total southern region of India. This means, only 56-60% of the power consumption in the project of FaL-G brick plants should be computed for emissions. However, as a conservative approach for submitting data in PDD, total power consumption has been accounted for thermal.<br><br>Default values provide for conservative estimates. |

| **Data / Parameter** | **$SEC_{clay\ brick}$** |
|---|---|
| **Unit** | $GWh_{th}/m^3$ brick |
| **Description** | Specific energy consumption of burnt clay bricks is taken as the base line energy consumption, which is provided in terms of mJ/kg brick that is duly converted to $GWh_{th}/m^3$ to tally with cap on energy as per approved methodology. |
| **Source of data** | 'Emission standards for brick kilns – an opportunity for technology upgradation' by Tata Energy Research Institute, Delhi, India. |
| **Value(s) applied** | 0.000725 $GWh_{th}/m^3$ |
| **Choice of data or Measurement methods and procedures** | Specific energy consumption for clay brick is calculated based on the weighted average of various processes, excluding the high energy consuming processes such as MCBTK. Thus this value gives conservative estimate for baseline. |
| **Purpose of data** | To compute baseline emissions. |
| **Additional comment** | India being a vast country with different conditions of practices, conservative value is taken for estimating baseline energy consumption which is in turn used to compute baseline emissions. |

| **Data / Parameter** | **$CEF_{coal}$** |
|---|---|
| **Unit** | t C/TJ |
| **Description** | Carbon emission factor for coal is used to compute the baseline emissions. |
| **Source of data** | IPCC default value |
| **Value(s) applied** | 25.8 t C/TJ |
| **Choice of data or Measurement methods and procedures** | As per provisions of II.D, IPCC values are taken wherever fossil fuels are used. |
| **Purpose of data** | To compute baseline emission. |
| **Additional comment** | Default values are taken for conservative estimates. |

### B.6.3. Ex-ante calculation of emission reductions

Emission reductions have been estimated applying the values mentioned in the above tables in the formulae presented earlier. The results for each plant included in the project are summarized in the following table:

| Sl. No. | Identification Number | Parameters to be monitored | | | Project Emissions estimate | | Baseline Emissions | | | Net Reductions | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Brick/Block Production | Electricity Consumption | Diesel consumption | Electricity consumption | Project Emissions | Thermal energy | Gross Emissions | Less for Biomass | Thermal energy | Emissions |
| | | $m^3$/year | $KWh_e$/year | Litres/year | $GWh_e$/yr | $tCO_2$/year | $GWh_{th}$/year | $tCO_2$/year | $tCO_2$/year | $GWh_{th}$/year | $tCO_2$/year |
| | | A | B | C | $D=B \times 10^{-6}$ | $E=D \times 0.9 \times 1000$ | $F=A \times 0.000725$ | $G=F \times 3.6 \times 25.8 \times 3.67$ | $H=G \times 0.05$ | $I = F-(D \times 3)$ | $J=G-H-E$ |
| 1 | AP/KRIS/I/1 | 4500 | 15750 | ** | 0.01575 | 14.175 | 3.2625 | 1111.08 | 55.55 | 3.21525 | 1041.35 |
| 2 | AP/KRIS/I/2 | 4500 | 15750 | ** | 0.01575 | 14.175 | 3.2625 | 1111.08 | 55.55 | 3.21525 | 1041.35 |
| 3 | AP/KRIS/I/3 | 4500 | 15750 | ** | 0.01575 | 14.175 | 3.2625 | 1111.08 | 55.55 | 3.21525 | 1041.35 |
| 4 | AP/KRIS/I/4 | 4500 | 15750 | ** | 0.01575 | 14.175 | 3.2625 | 1111.08 | 55.55 | 3.21525 | 1041.35 |
| 5 | AP/KRIS/I/5 | 4500 | 15750 | ** | 0.01575 | 14.175 | 3.2625 | 1111.08 | 55.55 | 3.21525 | 1041.35 |
| 6 | AP/KRIS/I/6 | 4500 | 15750 | ** | 0.01575 | 14.175 | 3.2625 | 1111.08 | 55.55 | 3.21525 | 1041.35 |
| 6 | AP/WG/I/7 | 4500 | 15750 | ** | 0.01575 | 14.175 | 3.2625 | 1111.08 | 55.55 | 3.21525 | 1041.35 |
| 7 | AP/WG/I/8 | 4500 | 15750 | ** | 0.01575 | 14.175 | 3.2625 | 1111.08 | 55.55 | 3.21525 | 1041.35 |
| 8 | AP/WG/I/9 | 3600 | 12600 | ** | 0.01260 | 11.340 | 2.6100 | 888.86 | 44.44 | 2.5722 | 833.08 |
| 10 | AP/EG/I/10 | 3600 | 12600 | ** | 0.01260 | 11.340 | 2.6100 | 888.86 | 44.44 | 2.5722 | 833.08 |
| 11 | AP/VSP/I/11 | 4500 | 15750 | ** | 0.01575 | 14.175 | 3.2625 | 1111.08 | 55.55 | 3.21525 | 1041.35 |
| 12 | AP/VSP/I/12 | 4500 | 15750 | ** | 0.01575 | 14.175 | 3.2625 | 1111.08 | 55.55 | 3.21525 | 1041.35 |
| 13 | AP/VZM/I/13 | 4500 | 15750 | ** | 0.01575 | 14.175 | 3.2625 | 1111.08 | 55.55 | 3.21525 | 1041.35 |
| 14 | AP/VZM/I/14 | 4500 | 15750 | ** | 0.01575 | 14.175 | 3.2625 | 1111.08 | 55.55 | 3.21525 | 1041.35 |
| | | **61200** | **214200** | | **0.21420** | **192.780** | **44.3700** | **15110.65** | **755.53** | **43.7274** | **14162.23** |

**B.6.4. Summary of ex-ante estimates of emission reductions**

| **Year** | **Baseline emissions ($tCO_2$ e)** | **Project emissions ($tCO_2$ e)** | **Leakage ($tCO_2$ e)** | **Emission reductions ($tCO_2$ e)** |
|---|---|---|---|---|
| Year 1 | 14355 | 193 | 0 | 14162 |
| Year 2 | 14355 | 193 | 0 | 14162 |
| Year 3 | 14355 | 193 | 0 | 14162 |
| Year 4 | 14355 | 193 | 0 | 14162 |
| Year 5 | 14355 | 193 | 0 | 14162 |
| Year 6 | 14355 | 193 | 0 | 14162 |
| Year 7 | 14355 | 193 | 0 | 14162 |
| Year 8 | 14355 | 193 | 0 | 14162 |
| Year 9 | 14355 | 193 | 0 | 14162 |
| Year 10 | 14355 | 193 | 0 | 14162 |
| **Total** | 143550 | 1930 | 0 | 141620 |
| **Total number of crediting years** | 10 years | | | |
| **Annual average over the crediting period** | 14355 | 193 | 0 | 14162 |

**B.7. Monitoring plan**
**B.7.1. Data and parameters to be monitored**

| | |
|---|---|
| **Data / Parameter** | $Q_{FaL\text{-}G}$ |
| **Unit** | $m^3$/ brick & $m^3$/ block |
| **Description** | SPEs maintain the actual quantities of production of different sizes of bricks/blocks in number in the stock registers which are duly converted to cubic meters. |
| **Source of data** | Stock registers of SPEs |
| **Value(s) applied** | 61,200m3; used in ex-ante calculations. |
| **Measurement methods and procedures** | SPEs record the production of bricks/ blocks on daily basis ($N_{FaL\text{-}G\text{-}i}$) that also includes their dimensions ($V_{FaL\text{-}G\text{-}i}$). These data are made available to PP once in a month in the form of the statement.<br><br>Based on the above data $Q_{FaL\text{-}G}$ is calculated as below:<br><br>$\mathbf{Q_{FaL\text{-}G} = N_{FaL\text{-}G\text{-}i} \times V_{FaL\text{-}G\text{-}i}}$ |
| **Monitoring frequency** | Daily |
| **QA/QC procedures** | Upon receipt of data on brick/block production and fuel use (electricity or diesel), from the plants on a monthly basis, ECPL will review the data. Depending upon the production capacity of individual plants, and raw materials used, certain benchmark figures are developed by ECPL for different parameters. In case significant deviations are noticed in the data provided by the entrepreneurs, ECPL will visit the site and correct the data in discussion with the entrepreneur. In addition, the Carbon Inspectors (officials of ECPL) of ECPL will also make surprise visits to FaL-G plants to check whether the process and FaL-G recipe used by the plant operators are within the acceptable range to ensure that quality of the products is not affected. Thus they would also tally the FaL-G recipe to the consumption of raw materials in order to check the diligence of record keeping and accuracy for ultimate diligence of emission computations. |
| **Purpose of data** | For computing baseline emissions |
| **Additional comment** | None |

| Data / Parameter | Fly ash procurement - $Fa_{con}$ |
|---|---|
| Unit | Tons |
| Description | The procurement of fly ash supported by inward challans/ weighment slips |
| Source of data | The raw material inward data as maintained by SPEs |
| Value(s) applied | 0 |
| Measurement methods and procedures | The quantities of fly ash as received at SPE units are duly recorded by them and sent to PP once in a month. |
| Monitoring frequency | As received by SPE |
| QA/QC procedures | The data received from SPE are tallied with the inward challans/ weighment slips during inspection visits and corrections, if any, are made. |
| Purpose of data | For computing baseline emissions as a cross check for production records and to arrive to the conservative estimate. |
| Additional comment | None |

| Data / Parameter | Specific fly ash consumption factor - Sp.Cfa |
|---|---|
| Unit | % |
| Description | Specific consumption factor of fly ash, Sp.Cfa, is derived based on the mix proportions declared by SPE at the time of enrolment into the project. For any reason, if the SPE changes the composition, he is advised to report the changed mix proportions to PE for carrying out necessary changes in the data bank. |
| Source of data | Interaction with SPE |
| Value(s) applied | 0 |
| Measurement methods and procedures | Based on the fly ash input in total FaL-G mix practiced at each SPE, specific consumption factor of fly ash, Sp.Cfa, is arrived in terms of %. This factor facilitates to compute 'Production based on fly ash consumption (Qfa)' as follows:<br><br>Qfa is calculated as: Facon/Sp.Cfa<br><br>where<br><br>Facon = total fly ash consumption of unit x for the corresponding year<br>Sp.Cfa = Specific Consumption factor of fly ash of the unit x, |
| Monitoring frequency | Once in six months at any month |
| QA/QC procedures | During inspection visits to the units, the Carbon Inspectors recheck the mix and record the changes, if any. Without recorded data, if there is conflict of data noticed at site during inspection, the conservative (higher) mix content will be taken that results in lower quantity of production based on fly ash |
| Purpose of data | For computing baseline emissions as a cross check for production records and to arrive to the conservative estimate. |
| Additional comment | None |

| Data / Parameter | Electricity - $Q_{Electricity}$ |
|---|---|
| Unit | kWhe |
| Description | The units are recorded periodically from the Electricity Meter installed by the service provider |
| Source of data | Electricity bills provided by the service provider (State electricity boards) |
| Value(s) applied | 214200 kWhe; used in ex-ante calculations |
| Measurement methods and procedures | SPEs submit to PE the electricity bill as provided by the Service Provider. The information is verified and tallied with the records of SPE by the personnel of ECPL periodically. For this purpose ECPL personnel are imparted with in-house training. |
| Monitoring frequency | Monthly/ bimonthly as provided by the service provider |
| QA/QC procedures | As the bills are provided by the state electricity boards no specific QA&QC procedures are applied. |
| Purpose of data | For computing project emissions |
| Additional comment | None |

| Data / Parameter | Diesel – $Q_{diesel}$ |
|---|---|
| Unit | Litre |
| Description | The quantities are recorded from the purchased bills. |
| Source of data | Purchase bills |
| Value(s) applied | 0 litres; used in ex-ante calculations |
| Measurement methods and procedures | The quantity in purchase bills is derived out of pumps those deliver the fuel. These pumps are monitored by statutory authorities and hence their bills are taken as final. |
| Monitoring frequency | Monthly |
| QA/QC procedures | All the information is verified and tallied with the records of SPE by the personnel of ECPL periodically. For this purpose in-house training is imparted to ECPL personnel. |
| Purpose of data | For computing project emissions |
| Additional comment | None |

**B.7.2. Sampling plan**

The units are visited randomly once in six months subject to minimum of 25% of operating units of the bundle.

**B.7.3. Other elements of monitoring plan**

The data involved in the project will be monitored and recorded by the FaL-G plant operators. The plant owners (entrepreneurs) will provide the data on production of FaL-G bricks/blocks and the consumption of diesel and electricity on a monthly basis to ECPL.

The following quality control measures are included. Upon receipt of data on brick/block production and fuel use (electricity or diesel), from the plants on a monthly basis, ECPL will review the data. Depending upon the production capacity of individual plants, and raw materials used, certain benchmark figures are developed by ECPL for different parameters. In case significant deviations are noticed in the data provided by the entrepreneurs, ECPL will visit the site and correct the data in discussion with the entrepreneur. In addition, the Carbon Inspectors (officials of ECPL) of ECPL will also make surprise visits to FaL-G plants to check whether the process and FaL-G recipe used by the plant operators are within the acceptable range to ensure that quality of the products is not affected. Thus they would also tally the FaL-G recipe to the consumption of raw materials in order to check the diligence of record keeping and accuracy for ultimate diligence of emission computations.

By calculating the key parameters based on the daily data collected at the plant site and sorting out the data gaps every month, the potential for large discrepancies is avoided. The purchase registers of different raw materials are also referred to in case of large discrepancies and the one that represents the lowest is accepted for conservative estimates.

ECPL also suggests individual entrepreneurs to test the strength of the FaL-G twice a year by sending the product to testing facilities/labs or by sending the product to INSWAREB lab.

Name of the person/ entity determining the monitoring methodology:

Institute for Solid Waste Research & Ecological Balance
FaL-G Mansion
35. Shri Venkateswara Colony
Visakhapatnam 530012

Name of Contact person:
N Kalidas
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The entity, Institute of Solid Waste Research and Ecological Balance is not a project participant.

**SECTION C. Duration and crediting period**
**C.1. Duration of project activity**
**C.1.1. Start date of project activity**

01/01/2003

**C.1.2. Expected operational lifetime of project activity**

15 years

**C.2. Crediting period of project activity**
**C.2.1. Type of crediting period**

Fixed crediting period

**C.2.2. Start date of crediting period**

01/04/2004

**C.2.3. Length of crediting period**

10 years

**SECTION D. Environmental impacts**
**D.1. Analysis of environmental impacts**

FaL-G plants, being very small industrial activities, do not require any environmental impact assessment study. However, the Project Entiry has carried out an environmental and social review of the project. The analysis reveals that FaL-G activity is environmentally benign and has several positive impacts. The principal beneficiaries of the project include

- Local communities: due to reduced negative environmental impacts from the traditional clay brick manufacturing process, such as land degradation and heavy air pollution, as well as reduced waste from better fly ash utilisation options.
- The global community, due to the expected reduction in GHG emissions and contribution for reduction to climate long-term change.
- Industrial and utility sectors, which would benefit from the reduced cost of waste disposal due to increased off-take by the FaL-G manufacturers.

The significant positive impacts on environment associated with the project largely outweigh the few negative impacts, which are mostly linked to the simple operational practices that are followed in small and micro scale FaL-G plants. These impacts are however manageable. The Project Entity has developed an Environment Management Plan/Good Practice Manual, which will be implemented at all the FaL-G plants. In addition, a specific Community Benefit Program has also been designed for the benefit of the workers**.** All these issues are documented as Environment & Social Review (ESR) and the salient features of this document are attached as Appendix 7.

The features of ESR would be covered in Sub-Project Agreement, to be exchanged between Project Entity and Sub-Project Entity (SPE). Accordingly the SPE has to implement the plants of ESR, which would be periodically monitored by Project Entity. Disciplinary action would be taken if SPEs prove as non-compliant.

**SECTION E. Local stakeholder consultation**
**E.1. Solicitation of comments from local stakeholders**

The yardsticks adopted in seeking stakeholders' comments on environmental impacts for scheduled industries in medium and large-scale sector are of different dimension. This project being an

agglomeration of tiny sector units scattered over a large geographical area, no special process has been adopted to invite the comments at National level.

However, Extensive consultations in various forms of promotional workshops have been carried out during the past years by INSWAREB on FaL-G, covering a wide range of stakeholders. While some of the workshops were at district level, some were relatively big events. The one conducted in 2001(October 18-19) and the two in 2003 (19.04.2003 at Cuddapah, and September 26-27 at Hyderabad) were some such events. As these workshops were conducted with service motto under knowledge-dissemination program, no registration fee was collected and, they were open to anybody interested. Government engineers, civil and structural consultants, builders, construction houses, researchers, and faculty from academic institutes and engineering colleges have attended these workshops, of course in addition to entrepreneurs, practicing FaL-G technology.

Notwithstanding these workshops, the project sponsors carried out several formal and informal consultations at different sites, targeting a range of stakeholders since 2003. The range of stakeholders consulted includes:

a) The entrepreneurs
b) The brick consumers
c) The local residents
d) The workers, manufacturing FaL-G blocks at FaL-G plants.
e) The suppliers of raw materials.

**E.2. Summary of comments received**

It may be noted that brick entrepreneurs, brick consumers, the local residents, the brick workers and the raw material suppliers are the principal stakeholders associated with the FaL-G activity. The response by the stakeholders has been generally positive about the product and the technology. However, certain concerns of these stakeholders are summarised below.

**FaL-G Entrepreneurs**

These entrepreneurs felt that carbon credits would help them in giving discounts in order to face stiff price competition from clay bricks.

They consider that the credits would be certainly an incentive to enthuse them in order to produce more FaL-G bricks and blocks and abate more $CO_2$.

Some of them wondered and got elated by realising the magnitude of their activity in contributing to the environment at global perspective.

Some of them questioned the authenticity of price and striking the deal at specified price.

**FaL-G consumers**

The consumers wondered whether they would get reduction in price of FaL-G blocks to the extent of credits received by their supplier. They argued that consumers were equally responsible for the generation of credits and, hence, it would be fair that the entrepreneurs share the benefits with them.

Some of them admitted that, whether they get carbon benefits or not, FaL-G bricks were their product of choice for avoiding at least 10-15% wastage, which is unavoidable with clay bricks produced with poor quality of clay and insufficient sintering.

Some of the builders hoped that, encouraged by carbon credit mechanism, more and more entrepreneurs would take up the production to increase the supply position so that their projects do not suffer scarcity, more so while their construction project based on FaL-G were halfway through.

**Local residents:**

Local folks desired that the raw materials in bulk, such as fly ash and stone dust, be handled in wet state so that there would not be dust emanation.

Some of them wished to get more and more plants so that employment potential to the youth would brighten up.

Giving reference to the proximity of the plant, many of them ascertained that they would be getting more qualitative product over clay brick for their constructions with least transportation cost.

Some of them have shown interest to become entrepreneurs and get into FaL-G activity, if they were assured of the technology support and carbon credit incentive.

**Brick Workers:**

Some of the workers argued that they are part of the production process and, thereby, they deserve to get a portion of the carbon benefit?

One section of the workers expressed that, as long as they get wages promptly with no interruption of work, they would wish their employer to get more and more such incentives.

**Raw material suppliers:**

All most all of them hoped that carbon incentive would ease the financial crunch of entrepreneurs and, in turn, may help in resolving undue payment-delays, which is a menace in construction industry.

**E.3. Report on consideration of comments received**

As can be seen from the previous section, the comments received from various stakeholders are largely positive. The concern on dust emanation from FaL-G units will be addressed by requiring the FaL-G units handle fly ash and stone dust in wet condition. The thermal plants do operate hydra-mixers so that the fly ash is delivered into the trucks of entrepreneurs without dust emanation. It is same with stone dust also.

With regard to workers' comments, FaL-G offers them continuity of work and wage-earnings, which is the basic need of a worker that could not be made possible with clay brick industry. In addition, a Community Benefit Plan comprising of welfare measures such as group insurance for accidents and death, and safe sanitation for workers will be implemented to enhance the workers' benefits.

**SECTION F. Approval and authorization**

Letters of approval from each Party involved in the project activity have been made available at the time of submitting the PDD to the DOE.

## Appendix 1: Contact information of project participants

| | | |
|---|---|---|
| **Organization** | Eco Carbon Pvt. Ltd. | |
| **Street/P.O. Box** | I Floor, 32-10-55, Sri Venkateswara Colony | |
| **Building** | INSWAREB Laboratory Building | |
| **City** | Visakhapatnam | |
| **State/Region** | Andhra Pradesh | |
| **Postcode** | 530012 | |
| **Country** | India | |
| **Telephone** | ++91-891-2516411 | |
| **Fax** | ++91-891-2517429 | |
| **E-mail** | info@co2credits.biz | |
| **Website** | www.co2credits.biz | |
| **Contact person** | N Bhanumathidas | N Kalidas |
| **Title** | Mg. Director | Executive Director |
| **Salutation** | Dr | Mr |
| **Last name** | Bhanumathidas | Kalidas |
| **Middle name** | | |
| **First name** | Nateri | Nateri |
| **Department** | Research & Development. | Business Development |
| **Mobile** | ++91-98410-79146 | ++91-98481-91453 |
| **Direct fax** | ++91-891-2517429 | ++91-891-2517429 |
| **Direct tel.** | ++91-891-2516411 | ++91-891-2516411 |
| **Personal e-mail** | bhanukali@vsnl.com | bhanuintl@sify.com |

| | |
|---|---|
| **Organization** | World Bank Carbon Finance Unit |
| **Street/P.O. Box** | 1818 H street NW |
| **Building** | MC |
| **City** | Washington |
| **State/Region** | DC |
| **Postcode** | 20433 |
| **Country** | USA |
| **Telephone** | 1202 473 9189 |
| **Fax** | 1202 522 7432 |
| **E-mail** | IBRD-carbonfinance@worldbank.org |
| **Website** | www.carbonfinance.org |
| **Contact person** | |
| **Title** | Manager, Carbon Finance |
| **Salutation** | |
| **Last name** | Evans |
| **Middle name** | |
| **First name** | Warren |
| **Department** | ENVCF |
| **Mobile** | |
| **Direct fax** | |
| **Direct tel.** | |
| **Personal e-mail** | |

## Appendix 2: Affirmation regarding public funding

No Public funding is availed.

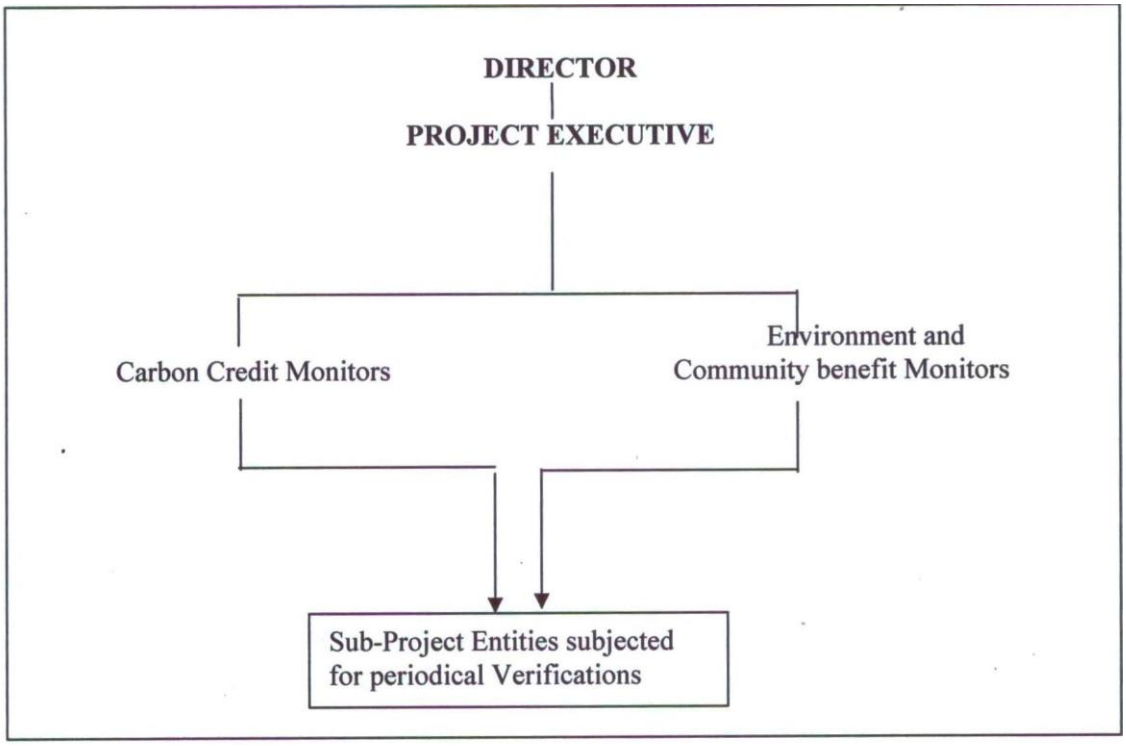
## Appendix 3: Applicability of selected methodology

Additional information - Nil

## Appendix 4: Further background information on ex ante calculation of emission reductions

| Sl. No. | Parameter | Variable | Values | Units | Remarks |
|---|---|---|---|---|---|
| | **Project related parameters** | | | | |
| | Emission factor of diesel | $EF_{diesel}$ | 0.0032 | $tCO_2$/litre | IPCC default |
| | Emission factor for electricity | $EF_{elec}$ | 0.9 | $tCO_2/MWh_e$ | IPCC default |
| | **Baseline related parameters** | | | | |
| | Density of conventional clay brick | $D_{clay\ brick}$ | 1.80 | Tons/$m^3$ | |
| | Specific energy of clay bricks | $SEC_{clay\ brick}$ | 0.000725 | $GWh_{th}/m^3$ brick | |
| | Carbon Emission Factor for Coal | $CEF_{coal}$ | 25.8 | tC/TJ | IPCC default |
| | Fraction of energy supplied by biomass in brick kilns | $R_{biomass}$ | 0.05 | | |
| | Carbon to $CO_2$ conversion factor | CC | 3.67 | $tCO_2$/tC | |

## Appendix 5: background information on monitoring plan



## Appendix 6: Summary of post registration changes

In view of conservative approach adopted by PE for computing the emission reductions, deviating from what was envisaged in registered PDD, monitoring plan has been commensurately revised in this PDD.

## Appendix 7: Salient features of Environment Monitoring & Community Benefit Plan (EMCBP)

All the SPEs should have concern for the welfare of environment, workers and community while carrying on their production.

Measures under this plan, as notified in the table below, would be executed by SPEs, under due supervisory coordination from Project Entity.

| **Activity** | **Intensity of compliance** | |
|---|---|---|
| | | |
| **Environment Monitoring Plan:** | | |
| To ensure covering raw materials with Plastic sheets, to prevent flying of dust. | Compulsory | |
| To increase the height of stack to a height of 2.0 mtr from workers-standing level, wherever diesel engines are used. | Compulsory | |
| To provide booklet to each worker on material handling and occupational health. | Compulsory | |
| Raw materials should be transported duly covered. | Compulsory | |
| Raw materials should be kept in closed conditions or wherever it is stored in open yards, it has to be duly covered. | Compulsory | |
| Bulk materials such as stone dust should be sprinkled with water to prevent dusting, during its storage in open yard. | Compulsory | |
| All internal roads may be paved and kept clean. | | Optional, as good practice. |
| Minimise spillage of oils and grease through suitable preventive maintenance. | Compulsory | |
| Wherever DG sets are used, SPE should obtain necessary guidelines and adhere to them. | Compulsory | |
| SPE should avoid leakage and wastage of water. If | | Optional, as |

| | | |
|---|---|---|
| possible, the surplus of the cured water may be recycled. | | good practice. |
| **Community Benefit Plan:** | | |
| **Insurance to Workers:**<br>**Basis: 12 workers per SPE**<br><u>Janata Personal Accident</u><br>To cover death, bodily injuries or permanent disability as a result of accident,<br>upto Rs. 1.00 lakh.<br><br><u>Swasthya Bheema</u><br>Individual Health Insurance policy to cover 24 hours of the day and not limited to place of employment. | Compulsory<br><br>Compulsory | |
| Personal Protection Gadgets:<br>Gum Boots, hand gloves and nose masks need to be given to workforce. | Compulsory. | |
| Health Check up for Workers:<br>Each worker needs to be checked up for health once in a year. | Compulsory | |
| HIV Awareness program:<br>All the workers need to be explained with virtues of safe sex and implications of AIDS. | Compulsory | |
| Toilets and bathing facility to workers together with taps, flush and overhead water tank: | Compulsory | |
| Protected Drinking water | Compulsory | |
| Do not employ child labour | Compulsory | |
| Ensure wage parity between male and female workers. | Compulsory | |

## Appendix 8: List of FaL-G Entrepreneurs (SPEs)

| Name & Address of the MIP | Name and relation of Authorised Signatory | Identification Number | Established in | Crediting period | Output/year in Cu.mtr | Energy Conserved per Year,GWth |
|---|---|---|---|---|---|---|
| **Krishna District, Andhra Pradesh** | | | | | | |
| Kodali Fly ash Products<br>7-60. Endowments Colony,<br>Nagarjuna Hospital Road, Kamayyatopu<br>Vijayawada, Krishna Dt. AP | K Srinivasa Rao<br>Proprietor<br>94401-72433 | AP/KRIS/I/1 | Feb-04 | 2004-2014 | 4500 | 3.2625 |
| Srinivasa Fly ash Bricks<br>Nunna, Vijayawada Rural Mandal<br>Krishna Dt. AP | G Bhaskar Reddy<br>Proprietor<br>9392103229 | AP/KRIS/I/2 | Jun-03 | 2004-2014 | 4500 | 3.2625 |
| Sri Sai Fly ash Products<br>D.No. 3-56. Kodalivari Street<br>Enikepadu, Krishna District, AP | K Padmavathi<br>Proprietrix<br>93929-41458 | AP/KRIS/I/3 | Jan-04 | 2004-2014 | 4500 | 3.2625 |
| Saiteja Brick Products<br>Chilkar, Ibrahimpatnam<br>Krishna Dist. AP | K Krishna Kishore<br>Proprietor<br>98489-49409 | AP/KRIS/I/4 | Jun-04 | 2004-2014 | 4500 | 3.2625 |
| Sridevi Fly ash brick Industries<br>Mustabad, Purushottapatnam<br>Gannavaram Mandal, Krishna Dist. AP | B Ramakrishna<br>Proprietor<br>98853-57555 | AP/KRIS/I/5 | Feb-04 | 2004-2014 | 4500 | 3.2625 |
| Venkata Lakshmi Industries<br>Shanti Ice Factory Compound, Ambarpet<br>Nandigama Mandal, Krishna Dist, AP | P. Narasimha Rao<br>Proprietor<br>9346452797 | AP/KRIS/I/6 | Aug-04 | 2004-2014 | 4500 | 3.2625 |

| Name & Address of the MIP | Name and relation of Authorised Signatory | Identification Number | Established in | Crediting period | Output/year in Cu.mtr | Energy Conserved per Year,GWth |
|---|---|---|---|---|---|---|
| **West Godavari District, Andhra Pradesh** | | | | | | |
| Srinivasa Fly ash Bricks<br>Pangidi Road, Besides FCI Godowns<br>Nidadavole, West Godavari Dist. AP | M Srinivasa Rao<br>Mg. Partner<br>94400-25786 | AP/WG/I/7 | Nov-03 | 2004-2014 | 4500 | 3.2625 |
| Kodandarama Fly ash Brick Industries<br>Venkayalapalem Road<br>Vissakoderu Post, Palakoderu Mandalam<br>West Godavari Dist. AP | Alluru Usharani<br>Proprietrix<br>98484-33688 | AP/WG/I/8 | Sep-03 | 2004-2014 | 4500 | 3.2625 |
| Sri Lakshmi Vasavi FaL-G Brick Industry<br>Door No. 16-145 Canal Road<br>Ramachandrarao Peta, Penugonda 534320<br>West Godavari Dist. AP | Ms. Satti Sri Varalakshmi<br>Proprietrix<br>94407-49959 | AP/WG/I/9 | Oct-03 | 2004-2014 | 3600 | 2.6100 |
| **East Godavari District-Andhra Pradesh** | | | | | | |
| Sri Satyasai Sri Anjaneya FaL-G Brick Industry<br>NH 214 Road, Sompalle Village- 533242<br>Razole Mandal, East Godavari Dist. AP | KVK Satyanaranaya Murty<br>Proprietor<br>94405-11257 | AP/EG/I/10 | Jan-03 | 2004-2014 | 3600 | 2.61 |
| **Visakhapatnam District-Andhra Pradesh** | | | | | | |
| Hemanth FaL-G Industry<br>Door No. 27-1-171. Srinagar<br>Gajuwaka, Visakhapatnam 530026 | Ms R Prasannakumari<br>Proprietrix<br>98493-33849 | AP/VSP/I/11 | Aug-03 | 2004-2014 | 4500 | 3.2625 |
| Vijayanagar FaL-G Brick Products<br>Muddapeta Jn. Dakamarri Post<br>Bheemunipatnam Mandal<br>Visakhpatnam Dist. AP | Y. V. Rao<br>Partner<br>98661-93624 | AP/VSP/I/12 | Feb-03 | 2004-2014 | 4500 | 3.2625 |

| Name & Address of the MIP | Name and relation of Authorised Signatory | Identification Number | Established in | Crediting period | Output/year in Cu.mtr | Energy Conserved per Year,GWth |
|---|---|---|---|---|---|---|
| **Vizianagaram District-Andhra Pradesh** | | | | | | |
| Vijayanagar FaL-G Brick & Block Products<br>Gorle Seetharampuram Post<br>Bibbili Mandal, Vizianagaram Dist. AP | Y.V. Rao<br>Partner<br>98661-93624 | AP/VZM/I/13 | Feb-03 | 2004-2014 | 4500 | 3.2625 |
| Vijayanagar FaL-G Products<br>Ambativalasa Post, Bondapalle Mandal<br>Vizianagaram Dist. AP | Y. V. Rao<br>Partner<br>98661-93624 | AP/VZM/I/14 | Aug-03 | 2004-2014 | 4500 | 3.2625 |
| **Grand Total:** | | | | | **61200** | **44.3700** |

# Appendix 9: Recommendation of Small Scale Working Group on Methodology

F-CDM-SSCwg ver 01 SSC_014

## CDM: Recommendation Form for Small Scale Methodologies (version 01)

***(To be used for presenting questions/proposals/amendments to the simplified methodologies for small-scale CDM project activity categories)***

| | |
|---|---|
| *Date of SSC WG meeting:* | 26 - 27 January 2006 |
| *Title/Subject (give a small title or specify the subject of your submission, maximum 200 characters):* | Avoidance of thermal energy input in the production of alternative building materials |
| *Indicative methodology to which your submission relates (refer the items of Appendix B of the Simplified Modalities and Procedures), if applicable.* | New category |
| *Name of the authors of the query:* | Mr. Lasse Ringius, Mr. Kirtan Chandra Sahoo |

<u>**Summary of the query:**</u>

Please use the space below to summarize the query related to SSC methodologies/categories SSC Modalities and Procedures provide recommendation/analysis of the SSC WG.

Mr. Lasse Ringius and Mr. Kirtan Chandra Sahoo submitted the following answers and further clarifications required by the SSC WG in its recommendation dated 16/09/2005:

**Discussion of proposed baseline alternatives.**

The SSC WG suggests expanding the set of baselines to cement bricks, fired clay bricks, and opened air-dried clay or ordinary soil bricks. We have considered this recommendation in detail but for the reasons given below these building materials do not constitute actual alternatives to the project activity. For that reason, the proposed methodology has not been modified to include these scenarios. However, fired clay bricks constitute the baseline for the proposed methodology.

**Cement Concrete blocks**

The cement concrete block market is a separate market and thus not a plausible alternative to fly-ash bricks. Fly-ash bricks/blocks are not penetrating this market, and consumers who need cement bricks generally do not switch to fly ash bricks. Fly-ash bricks do not penetrate the market for cement concrete bricks, but the fired clay bricks market.

**Fired Clay Bricks**

The baseline for the proposed methodology is fired clay bricks, which are also called sintered clay bricks.

**Opened Air-Dried Clay or Ordinary Soil Bricks**

Application of air-dried clay brick is in Economically Weaker Section (EWS) housing, mostly in a rural scenario, for thatched-roof houses and other semi-pucca or kutcha (raw) houses. Those who depend on these products cannot afford even sintered clay brick. Those who cannot afford sintered clay bricks cannot afford to purchase fly-ash bricks. Hence opened air-dried clay or ordinary soil bricks do not constitute a plausible baseline alternative to fly-ash bricks.

**F-CDM-SSCwg ver 01 SSC_014**

| **Recommendation by the SSC WG :** Please use the space below to provide amendments /change (in your expert view, if necessary). |
|---|
| |
| **Answer to authors of query by the SSC WG :** Please use the space below to provide an answer to the authors of the above query |

The reference is made to your query dated 28 November 2005. The small scale working group (SSC-WG) of the CDM Executive Board would like to thank you for submitting further clarifications on proposed baseline alternatives in response to the recommendation of the SSC WG dated 16/09/2005.

As a result of the discussion of related submissions including your query, the SSC-WG agreed on the following matters:

- According to the *Technology/measure* section as below (Para A), the proposed methodology is applicable to projects which introduce equipments at facilities manufacturing building materials including bricks, and reduce or eliminate completely the use of thermal energy from fossil fuels, and possibly from renewable biomass. The targeted projects are apparently energy efficiency improvement projects. So the proposed methodology must belong to Type II and not to other types.

*A. Technology/measure in the proposed new methodology*

*This project category comprises equipment that would reduce or eliminate completely the use of thermal energy from fossil fuels, and possibly from renewable biomass, by implementing the equipment at many facilities manufacturing building materials. The equipment may replace equipment at existing facilities or be installed at new facilities. Equipment may be implemented in small-scale brick manufacturing plants, etc. The project activity shall both reduce anthropogenic emissions by sources, and directly emit less than 15 kilotonnes of carbon dioxide equivalent annually.*

- For the energy efficiency improvement projects in factories, category II.D. "Energy efficiency and fuel switching measures for industrial facilities" of the Appendix B of the simplified modalities and procedures for small-scale CDM project activities is applicable. It covers not only the energy efficiency improvement in electricity but also thermal energy. So project participants do not need to propose a new methodology.

*B. Technology/measure: category II. D.*

*This category comprises any energy efficiency and fuel switching measure implemented at a single industrial facility. This category covers project activities aimed primarily at energy efficiency; a project activity that involves primarily fuel switching falls into category III.B[1]. Examples include energy efficiency measures (such as efficient motors), fuel switching measures (such as switching from steam or compressed air to electricity) and efficiency measures for specific industrial processes (such as steel furnaces, paper drying, tobacco curing, etc.). The measures may replace existing equipment or be installed in a new facility. The aggregate energy savings of a single project may not exceed the equivalent of 15 GWhe per year. A total saving of 15 GWhe per year is equivalent to a maximal saving of 45 GWhth per year in fuel input.*

The activity replacing the equipment at many facilities manufacturing building materials would also reduce or eliminate the use of thermal energy from renewable biomass. However, this component of the activity may not result in emission reductions. .

[1] *Thus fuel switching measures that are part of a package of energy efficiency measures at a single location may be a part of a project activity included in this project category*

**F-CDM-SSCwg ver 01 SSC_014**

Signature of SSC WG Chair ……………………………………………………..
Date: 27 / 01 /06 *(Gertraud Wollanksy)*

Signature of SSC WG Vice-Chair ……………………………………………………..
Date: / / *(name)*

| Information to be completed by the secretariat | |
|---|---|
| SSC-Submission number | SSC_014 |
| Date when the form was received at UNFCCC secretariat | 13 February 2006 |
| Date of transmission to the EB | 13 February 2006 |
| Date of posting in the UNFCCC CDM web site | 13 February 2006 |

**Appendix 10 : Specific Power and Diesel Consumption at SPE units ***

| Unit ID | Name of the SPE | Plant Type | Workforce during study | Study time, hours | Units consumed, kWh | Output, cu.m | Sp. Power consumption kWh/ Cu.m | Power utilization factor-kWh |
|---|---|---|---|---|---|---|---|---|
| **Study on Power Consumption** | | | | | | | | |
| AP/KRIS/I/1 | Kodali Fly ash Products | I | 8 | 2 | 4.00 | 3.33 | 1.20 | 1.20 |
| AP/KRIS/I/2 | Srinivasa FaL-G Bricks | II | 8 | 2 | 4.50 | 4.05 | 1.11 | 1.20 |
| AP/KRIS/I/3 | Sree Sai Fly ash Products | II | 9 | 4 | 13.00 | 10.80 | 1.20 | 1.20 |
| AP/KRIS/I/4 | Sri Sai Teja Brick Products | II | 9 | 2 | 6.00 | 5.15 | 1.17 | 1.20 |
| AP/KRIS/I/5 | Sree Devi Fly Ash Industries | III& DG | 8 | 2 | 6.50 | 4.65 | 1.40 | 1.54 |
| AP/KRIS/I/6 | Venkata lakshmi Industry | II | 10 | 4 | 11.00 | 10.35 | 1.06 | 1.20 |
| AP/WG/I/7 | Srinivasa Fly ash Bricks | III&IV | 10 | 2 | 6.50 | 4.22 | 1.54 | 1.54 |
| AP/WG/I/8 | Kodanda Rama Flyash Brick industries | III | 10 | 4 | 8.50 | 8.10 | 1.05 | 1.54 |
| AP/WG/I/9 | Sri Lakshmi Vasavi Fal-G Brick Industry | III&DG | 10 | 4 | 14.00 | 9.40 | 1.49 | 1.54 |
| AP/EG/I/10 | Sri Sathya Sai Sri Anjaneya Fal-G BR. Industry | III&IV | 9 | 2 | 5.50 | 3.60 | 1.53 | 1.54 |
| AP/VSP/I/11 | Hemanth FaL-G Industry | VII | 9 | 4 | 22.00 | 9.15 | 2.40 | 2.40 |
| | | | | | | | | |
| **Study on Diesel Consumption** | | **Plant Type** | **Workforce during study** | **Study time, hours** | **Diesel consumed, kWh** | **Output, cu.m** | **Sp. Diesel Consumption, Litre/cu.m** | **Diesel utilization factor - Ltr** |
| AP/EG/I/10 | Sri Sathya Sai Sri Anjaneya Fal-G BR. Industry | IV | 9 | 4 | 6 | 6.07 | 0.99 | 1.00 |

*Data collected based on the studies of site operations

**History of the document**

| Version | Date | Nature of revision |
|---|---|---|
| 04.1 | 11 April 2012 | Editorial revision to change history box by adding EB meeting and annex numbers in the Date column. |
| 04.0 | EB 66<br>13 March 2012 | Revision required to ensure consistency with the "Guidelines for completing the project design document form for small-scale CDM project activities" (EB 66, Annex 9). |
| 03 | EB 28, Annex 34<br>15 December 2006 | • The Board agreed to revise the CDM project design document for small-scale activities (CDM-SSC-PDD), taking into account CDM-PDD and CDM-NM. |
| 02 | EB 20, Annex 14<br>08 July 2005 | • The Board agreed to revise the CDM SSC PDD to reflect guidance and clarifications provided by the Board since version 01 of this document.<br>• As a consequence, the guidelines for completing CDM SSC PDD have been revised accordingly to version 2. The latest version can be found at <http://cdm.unfccc.int/Reference/Documents>. |
| 01 | EB 07, Annex 05<br>21 January 2003 | Initial adoption. |
| **Decision Class:** Regulatory<br>**Document Type:** Form<br>**Business Function:** Registration | | |